آثار استخدام البلاستيك على البيئة والإنســـــان

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الملخص

تحاول ورقة العمل هذه التعرف على مفهوم البلاستيك ودوره الحيوي الهام في حياتنا المعاصرة فقلما نجد منتجا صناعيا يخلو من أحد أنواع البلاستيك ،كما تتطرق إلى دراسة التلوث البلاستيكي و الآثار البيئية و الصحية والذي يسببها نتيجة للطرق التقليدية في التخلص من النفايات البلاستيكية والمتمثلة في الحرق والطمر وإلقائها في البحار والمحيطات و التي بدورها تسبب أضرار جسيمة للكائنات الحية والبيئة و يعزى هذا الضرر الناتج من النفايات البلاستيكية إلى احتوائها على مواد بوليميرية لا تتحلل بفعل العوامل الطبيعية سواء البيولوجية أو البيئية وكذلك احتوائها على مواد كيميائية مضافة لغرض تحسين خصائصها وتقليل تكلفتها ، الأمر الذي أدى إلى اهتمام كثير من دول العالم لاظهار عدة طرق حديثة للتخلص والاستفادة من المخلفات البلاستيكية والتي تشمل إعادة التدوير وانتاج الطاقة واستحداث البديل لبعض المنتجات البلاستيكية مثل البلاستيك الحيوي، كما دلت التجارب الناجحة على أهمية إقرار تشريعات وقوانين خاصة للتعامل مع المخلفات البلاستيكية على المستوى الدولي و الإقليمي و المحلي .

Impacts of Plastic Use on Environmental and Human

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Abstract

This paper tries to identify the concept of plastic and its important vital role in our contemporary life. We don’t find an industrial product without one of the types of plastic. The study of plastic pollution, effects the environmental and the human health. It causes many problem as a result of traditional methods of disposal of plastic waste, which are burning and landfilling and dumping them in the seas and oceans. These in turn cause serious damage to living organisms and the environment. This damage from plastic waste is due to the fact that it contains polymeric substances which are not degraded by natural factors, whether biological or

environmental. The waste is containing added chemicals for the purpose of improving their properties and reducing their cost. This has led to the attention of many countries of the world to show several modern ways to dispose and get benefit from plastic waste, which includes recycling, energy production and the development of alternative to some plastic products such as bioplastics. Successful experiments have also shown the importance of adopting special legislation and laws to deal with plastic waste at the international, regional and local levels.

Keywords: plastic, polymer, waste, recycling.

1- Introduction

The problem of plastic pollution, which is the subject of this study, has become disturbing to researchers and those interested in the environment, because of the serious health and environmental problems it causes unless it is managed by scientific methods aimed at finding ways to turn them into resources of economic value and reduce their risks to the environment. Since industrial plastic production began in the 1950s, the volumes of plastics produced have exceeded those of almost any other substance with studies estimating that plastic production consumes 3 to 5% of the world's total crude oil production annually and that in 2012 280 million tons of plastic were produced globally (Markus et al., 2014).

Plastic material, despite its various characteristics such as strength, flexibility, light weight, low cost, ease of formation, corrosion resistance, also effective in insulating heat, electricity and its ability to form to suit its purposes. The resistance to corrosion due to acids, alkalis and solvents. It is not analyzed by natural factors such as bacteria, fungi, yeasts or environmental heat, humidity,

light, sunlight, oxygen, chemicals, etc. but its resistance to decomposition by these factors, especially biological ones. The most important is the large size of the particles of this substance and its insolubleness in water, making its successors one of the main sources of environmental pollution and a threat to human health.

The health, environmental and economic causes have become clear. It has led to a growing international insistence on reviewing and assessing the use of plastics at all stages of its life cycle, which includes not only design and manufacturing but also use, reuse, end-of-life management, with a particular focus on inputs and the removal of plastics from the environment.

2- Search objectives:

This paper aims to look at its extreme importance to:

- Study the most important aspects related to plastic waste and its impact on the environment and the health of living organisms.
- Develop ways to benefit, dispose and reduce plastic waste.
- Find a suitable alternative to traditional plastics made of gas and oil.

3- Plastic

Plastics consist of long chains of molecules called polymers that are formed by the association of a large number of small molecules called monomers. Polymers usually contain carbon, hydrogen, chlorine, nitrogen and other elements. Due to the length of polymer chains, the basic chemical bonds that bind the components dissolve with heat and break down before the chains are separated by the large energy of the secondary bonds and physical entanglement between them. So the polymer does

not turn into gas like other substances due to heat. For the required plastic properties of softness, flexibility, strength, fire resistant, water repellent and others are added different types of chemicals. It uses a wide range of additives that improve properties and facilitate the manufacture and reduction of cost such as fillers, thermal and photovoltaic stabilizers, plastics, softeners, antioxidants, anti-electrification substances, flame retardants and colorants (Rudolph, 1975).[1]

In 1907, Belgian chemist Leo Bakiland (1863−44) created the first industrial polymer to process two organic compounds, phenol and formaldehyde, called "Bakelet", which would revolutionize the plastics industry. Buckland founded a plastics production company called Bakelite Corp., and it wasn't long before the industrial polymer, Bucklette, made its way to many industries, including automotive clothing, electrical and building materials, food packaging and supplies. Medical, communications and electronics.

4- **Types and uses of plastic**

Most of the plastic currently used depends on petroleum. And according to the components and materials used in the industry, there are different types of plastic:

- Type 1: Plastic made of polyethylene terephthalate (PET). Polyethylene terephthalate is used in the manufacture of juice cans, mouthwash, vegetable oils, cosmetics, soft drinks, ghee and water bottles. [2]
- Type 2: Plastics made of polyvinyl chloride (PVC), used in the packaging of fruit juices and edible oils, and because of the presence of harmful chemical components (heavy metals, dioxins and phthalates), polyvinylchloride is considered

highly toxic, and research has revealed its role in bronchitis, birth defects, cancer, skin diseases and dysfunction of the liver, so its use has decreased clearly in some countries recently, but it is still used in other countries. [3]

- Type 3: Plastic made of polystyrene (PS). Polystyrene is generally used in the production of insulators and packaging materials, and its products pose a health hazard, and this type of plastic contains gasoline, a substance classified as human carcinogen. Studies have revealed that prolonged exposure to sterin affects nerves and causes cellular, carcinogenic and hematological effects. [4]
- Type 4: polycarbonate is used to fill consumer goods and reusable bottles. This type of plastic contains bisphenol-a, a dangerous substance that can lead to high temperatures leaking into food or beverages, and after reporting the confirmed health risks of bisphenol-A in many studies, the use of multi-carbon plastic has decreased significantly. [5]

5- Plastic pollution

Plastic pollution is the accumulation of plastic objects within the environment, which interferes with organ functions. The plastic pollution affects human health through direct consumption (i.e. in tap water), indirect consumption (by eating animals) and thus disrupting different hormonal mechanisms. [6]

6- Types of plastic waste

Depending on its size, plastic waste is divided into small and medium-sized waste, with plastics ranging in size from 2 to 5 mm called microplastics while plastics of up to 20 mm are called plastic macros. There is huge and total plastic in

packaging, shoes and other household items, and since the phenomenon of dumping waste of various kinds, including plastic waste, has spread in public places and on the sides of roads or in water and beaches so that these wastes are transmitted by wind in the roads and streets, causing serious pollution to the environment and harming the overall appearance of cities and villages. These wastes were collected in huge piles resembling small hills on the outskirts of cities, on the sands of beaches and within residential neighbourhoods and became a fertile breeding ground for germs, microbes and insects.[7]

Plastic debris is classified as either basic or secondary. The raw plastics are in their original form when collected. Examples of these include bottle caps, cigarette butts, and microbides on the other hand, secondary plastics represent smaller plastics resulting from the degradation of primary plastics.

7- Environmental and health impacts of plastic residue pollution

7-1- Environmental impacts

The impact of plastic pollution on the soil: Soil is the natural element directly affected by various residues on its surface that lead to severe burning of soil, which loses the ability to germinate and loses its ability to absorb and represent, and thus rain water transports these pollutants such as organic acids, nitrogen compounds and bacteria to groundwater. In addition, contaminated soil needs at least a period of time to live from 20-30 years to get rid of its pollutants. The complex composition of the soil and its various properties and the

presence of many organic and inorganic pollutants make it difficult and costly to remove them. [8]

The impact of plastic pollution on ground water: Water pollution means any change in the natural, chemical or biological characteristics of any water source that would cause harm or harassment to the beneficiary of this bumper. The disposal of solid waste by dumping it on the surface of the earth is a source of contamination of surface and ground water. These wastes are usually disposed of by dumping them in open places called dumps. The most of these places are considered abandoned and do not observe any specific rules. They do not meet the appropriate geological conditions at its base, where it turns into small plastics and fine particles, leakage and leaching of waste causes contamination of ground water, especially if the area is exposed to rainfall. So dealing with solid waste in an improper manner leads to chemical and biological contamination of groundwater. This causes serious damage to all organisms that feed or drink from water. [9]

The impact of plastic pollution on the oceans: Many cities find it is difficult to obtain land to use as dumps for their solid waste or that their traditional dumps have been filled and cannot absorb more. So they are resorting to the seas because of their vast area are able to absorb all the waste dumped in them or are able to clean themselves up. They are using locomotives specifically for this purpose sailing loaded with waste to the sea in order to empty their cargo. Many studies have shown that the marine environment suffers from severe pollution due to the dumping of plastics into the sea. It has been found in a square kilometer of the Mediterranean more than 2086 pieces of

plastic, and it is known that plastic resists decomposition and accumulates in the environment frighteningly; Breathing gills, sea turtles are devoured by plastic, including jellyfish, which are delicious meals, and then die as a result of clogged intestines with these inescapable bags. [10]

The impact of plastic pollution on the air: nylon and plastic materials that are introduced in many industrial uses such as paints, some office tools, household and construction materials as well as cars, submarines and aircraft, and insulating materials in the lining of diapers, where some studies indicate that only the United States used during 1990 a.m. about 15.8 billion pieces of diapers, an average of 433 A million pieces a day. When these plastics are burned, dioxin and carcinogenic PVC are produced, where studies have shown that it produces between 1046 and 2408 microgram dioxins /ton of garbage and this substance causes cancer, especially in the eye [11], liver and kidney network, as well as causing circulatory disorder and skin sensitivity, all products of indiscriminate burning of garbage harm health. Especially children, the elderly, the infirm, heart patients and kidney failure patients. [12]

7-2- Health impacts

The health effects of plastic pollution lie in the following [13]:

- Open burning of plastics, plastic products and waste releases other pollutants, including heavy metals and dioxins, which pollute the air and cause health risks to the respiratory system.
- Most additives in plastics, such as bisphenol-A these additive (BPA, phythalates, pcPs), have adverse effects on humans. Some of them carcinogens, and cause disorders of the glands,

hormones and liver enzymes, cardiovascular disease, type 2 diabetes, neurological disorders, skin infections, prostate cancer and breast cancer.

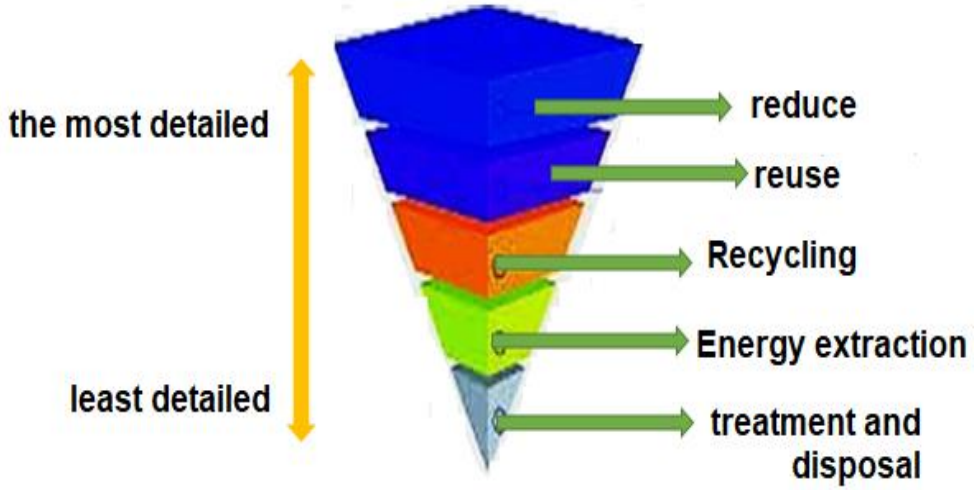
- Plastic particles from the cultivation of plastic joints cause patients to disintegrate body tissues and disrupt their functions.
- Types of unsafe plastics for food, medicine and beverages, including high-density polyethylene plastics, which are most commonly used worldwide. low-density polyethylene and polypropylene plastic, are used to fill medicines, dairy and juices, resulting in. Food poisoning and causing complex health problems, the most important of which is an increased chance of infertility, cancer, hormonal imbalance in the body and disorders in the main causes of plastic pollution.

8- Plastic waste management

Although land filling is the most common traditional approach to waste management in many countries. The scarcity of landfill areas has become a problem in many countries. So incineration is an alternative to plastic landfilling, but there are growing concerns about hazardous chemical emissions during incineration, where burned waste releases fumes and harmful and air-polluting gases. Some incineration products can interact with water, changing the figure. Hydrogen, therefore, affects the performance of aquatic ecosystems. Some other products, soot, ash and other powders, settle on plants or in the soil. Hydrogen may be transmitted to the aquatic environment, or absorbed by plants, which are fed by humans, animals and birds, and thus enter plastic particles into the food chain. Because of its most serious impact on the environment, plastic burning is less commonly used than landfilling and recycling in most countries of the world except

Sweden, Denmark and Japan. It has large solid waste management and burning facilities, including plastics. Most plastics are non-biodegradable, so the basic work must be reducing waste generation, effective management and recycling. However, the term recycling is complex, and includes four types of primary treatment. It includes mechanical waste treatment and the reproduction of a new product with the same characteristics. Secondary treatment, including mechanical processing of plastic and conversion into a product with lower quality properties. The third treatment involves the recovery of chemical components of plastic. The fourth treatment, which includes the recovery of energy from plastic. While metal recycling can be economically profitable, plastic recycling is not, there are technical difficulties in recycling some types of plastics, especially those made of polyethylene and polypropylene. In the UK, about 5 million tonnes of plastic are consumed annually, but only a quarter are recycled [14].

Next figure shows the best method for the disposal of plastic waste, where reduction is the best, followed by reuse, recycling, energy recovery, and finally treatment and disposal.



The best way to dispose of plastic waste

For previous reasons, researchers are seeking an appropriate alternative to traditional plastics made from oil and gas. Research has resulted in the creation of organic plastic bioplastics made from certain raw and renewable plant. Materials such as corn, wheat, potatoes and sugar cane, where starch, sugars and cellulose are obtained by some biochemical treatments. This type of biodegradable plastic is manufactured over a relatively short period of time. Researchers are increasingly seeking to develop these materials as a means of providing fossil fuels. Reducing emissions of toxic gases and harmful plastic wastes is the following form showing the best method of disposal of plastic waste, where reduction is best followed by reuse, followed by recycling, followed by energy extraction and finally treatment and disposal.

9- Legislation and laws for dealing with plastic waste

There are a variety of regulatory and legislative tools aimed at controlling the reduction and management of the use of plastics

with particular recommendation on single-use plastics, the current legislation consists mainly of [15]:

- Taxes imposed.
- Voluntary efforts through R3.
- Reduce reuse and recycling.

However, these regulatory tools have had a limited impact in terms of amount, scope or both. Taking into account the exponential annual increase in the production and use of plastics. The need for improvements in plastic legislation to be able to better consider and address environmental impacts and human health. The most of the urethletes are designed to treat plastic waste at the end of their life cycle, i.e. the need for preliminary legislative approaches to stimulate the goal of disposal. From zero waste, which undoubtedly improves the effectiveness of plastics politics in the future.

Given that some plastics such as polyurethane, PVC and epoxy resins cause mutations and/or cancer. Some plastic-related chemicals are dangerous. It is clear that there is a need to establish and develop the implementation of legislation aimed at reducing the ever-increasing threats to plastics, and such legislation may exist at different levels including local and regional levels.

10- Facts and information about plastic pollution [16]

- Approximately 10 billion tons of plastic are manufactured annually.
- When any piece of plastic is manufactured, it poses a serious risk because it does not decompose until hundreds of years later.
- Nearly 500 million plastic hoods are used to drink juice used daily only within America.

- There are about 2 million plastic bags consumed worldwide every minute and are not recycled because they do not decompose in any way until hundreds and thousands of years have passed.
- A million bottles made of plastic are consumed and purchased around the world every minute.
- Approximately 8 million tons of plastics are encountered within the oceans.

11- Conclusion

Several studies have confirmed that plastic waste has serious damage to the environment and human beings if not dealt with properly. So plastic waste management has become a major topic that receives increasing attention in all countries. Studies are translated by investments in establishing integrated infrastructure for the reuse and recycling of plastic waste. Providing incentives to investors in this sector supported by the adoption of legislation prohibiting the dumping of plastic waste in non-designated places or disposal through burials or cremations.

12- Recommendations

Based on the findings of this study, the researcher recommended:

- Educating citizens about the dangers of plastic waste to humans and the environment deal with it in a scientific way. Working to create a common association or system between state institutions and production companies in various fields. Individuals resort to effective work towards contributing to plastic recycling because of its positive impact in preserving raw materials and reducing plastic waste

- Use several methods to prevent waste dumped in the oceans to reduce plastic pollution because it threatens human and animal health.
- We have to rotate the plastic bags that are used inside the markets and widespread in waste areas.
- Garbage waste must be divided in order to help the population sort the garbage so it is easy to recycle plastic as well as cardboard in order to maintain our health, the environment, as well to protect marine organisms from this serious danger.
- We must limit and reduce plastic consumption and use globally and work on safe alternatives to packaging for plastic, bioplastics and glass to replace plastic bags with special shopping bags.

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